Appendix

Elementary Level Sample Rubrics for Process Skills

Classifying

Criteria	Proficient	Basic	In Progress
Sort/Group	Recognizes and creates complex groups using more than one attribute; can classify more than one attribute at a time.	Recognizes attributes and creates simple groups.	Randomly manipulates objects; haphazardly sorts/groups.
Matching	Identifies needed information; can see and explain connections.	Can recognize similar attributes.	Randomly manipulates objects; makes matches haphazardly.
Communication of Attributes	Communicates results clearly and logically; can communicate ideas in several forms (orally, in writing, drawings, graphs).	Can use simple explanations to communicate ideas.	Cannot explain work or strategy adequately.

Communicating

Criteria	Proficient	Basic	In Progress
Conveying Information	Can communicate ideas in three or more forms (orally, written, drawings, graphs).	Can communicate ideas in one or two forms (orally, written, drawings, graphs).	Difficulty in expressing ideas.
Data Collection	Accurately and completely collects and organizes data.	Collects and organizes data with some inaccuracy.	Data not completely collected or is inaccurately organized.
Explaining Thinking	Explains thinking process using details that explain or support the idea or topic; applies thinking process to make ideas clear or concise.	May need assistance or prompts to explain thinking process; uses details that explain or support the idea or topic.	Withdraws from discussion; unable to explain thinking process; no details to show understanding.

Connections

Criteria	Proficient	Basic	In Progress
Extensions	Explores and relates ideas.	Recognizes similar situations.	No attempt to relate ideas.
Application	Extends connections to "real" world.	Makes connections to other subject matter.	Cannot apply ideas.

Elementary Level Sample Rubrics for Process Skills

Interpreting Data

Criteria	Proficient	Basic	In Progress
Makes Inferences	Carefully considers all information; can analyze components; sees many connections within data.	Does not consider all possibilities; examines components with some inferences; sees some connections with data.	Draws minimal information from instruction; does not show initiative in analysis; recognizes few connections within data.
Communicating	Designs tool for communicating; reports facts and insightful information.	Conveys information by reporting basic facts.	Rarely offers information; cannot design tool for conveying information.
Drawing Conclusions	Interprets with clarity and creativity; shows initiative in summarizing; able to extrapolate beyond known data; makes highly accurate predictions; solutions are reasonable.	Interprets information adequately; can draw some conclusions from data, unable to extrapolate beyond known data; uses good judgment for some predictions; solutions are reasonable with minimal flaws.	May answer simple questions if prompted; makes faulty assumptions; cannot draw conclusions; makes faulty predictions, if at all; solutions are unreasonable.

Measuring

Criteria	Proficient	Basic	In Progress
Uses Standard and Non-Standard Measurement with Accuracy	Able to measure using standard and non-standard units to fractional increments.	Able to measure using standard and non-standard units.	Unable to measure using standard and non-standard units.
Selection/Use of Measuring Tool	Selects appropriate measurement units for task and demonstrates appropriate use of measurement equipment/tool.	Can select measurement unit and use measurement tool, but it is not the most appropriate unit or tool for the task.	Recognizes differing measurement units but is unable to apply them appropriately to the tasks; can use measurement tool with assistance.
Solves Problems Using Measurement	Develops procedures/ formulas to solve problems related to measurement.	Solves problems related to measurement.	Solves problems related to measurement with assistance.

Elementary Level Sample Rubrics for Process Skills

Observing

Criteria	Proficient	Basic	In Progress
Uses Senses	Uses all five senses interchangeably to gain information about objects or events; descriptively communicates information about all attributes/properties.	Uses all five senses to gain information about objects or events; communicates information gained about some, but not all attributes/properties.	Uses some of the five senses to gain information about objects or events; needs assistance communicating information gained.
Applies Information	Identifies and compares attributes/properties of object or event in order to solve problems and extends this knowledge to other situations.	Identifies and compares attributes/properties of object or event in order to solve problems.	Identifies attributes/properties of object or event but needs assistance using this information to solve problems.

Patterning

Criteria	Proficient	Basic	In Progress
Recognition	Recognizes complex patterns. (AABAAB - AABAAB...)	Recognizes simple patterns. (AB - AB - AB...)	Does not recognize patterns.
Continue/Reproduce	Proposes and explores extensions.	Makes connections and recognizes similar applications.	Does not make connections to continue pattern.
Communication	Communicates patterns clearly and effectively.	Can support simple explanations of patterning.	Cannot explain patterns.

Elementary Level Sample Rubrics for Process Skills

Predicting

Criteria	Proficient	Basic	In Progress
Uses Prior Knowledge	Applies relevant prior knowledge to new situations.	Prompting or assistance needed to apply relevant prior knowledge to new situations.	Unable to apply relevant prior knowledge to new situations.
Forecasting	Uses inferences to make a specific prediction of what a future observation will be.	Prompting or assistance needed to use inferences to make a specific prediction of what a future observation will be.	Unable to use inferences to make a specific prediction of what a future observation will be.

Problem Solving

Criteria	Proficient	Basic	In Progress
Clarifies the problem	Can restate or explain the problem coherently.	Misinterprets or misunderstands part of the problem.	Does not attempt the problem or misunderstands the problem.
Formulates and Applies Strategies, Concepts, and Procedures.	Knows and uses many strategies; generates new procedures.	Knows and uses a limited number of strategies; can complete work in an acceptable manner.	Makes no attempt to do the problem; cannot explain work or strategy adequately.
Collects, Organizes, and Displays Data.	Can collect and display data in an organized manner.	Has minor flaws in collecting or displaying data.	Makes no attempt or makes major mistakes in collecting or displaying data.
Summarizes and interprets results.	Draws valid conclusions/ interpretations; makes sound generalizations.	Summarizes and describes data appropriately; can generate/answer questions related to data.	Makes no attempt to summarize or describe data.
Communicates Results	Communicates clearly and effectively; explains thinking process well; can communicate ideas in several forms.	Expresses ideas in simple form; can support simple explanations; uses some terms appropriately.	Has difficulty communicating ideas; cannot bring thinking to conscious level; does not use or misuses terms; offers unrelated information.

Elementary Level Sample Rubrics for Process Skills

Hypothesizing Upper Level

Criteria	Proficient	Basic	In Progress
Research	Independently demonstrates research skills using a variety of resources.	Demonstrates research skills with teacher/peer assistance.	Unable to demonstrate research skills.
Observation	Independently demonstrates observation skills.	Demonstrates observation skills with teacher/peer assistance.	Unable to demonstrate observation skills.
Questioning	Independently able to formulate pertinent questions reflecting higher-level thinking skills.	Able to formulate pertinent questions with teacher/peer assistance.	Unable to formulate questions.
Inferences	Independently able to use content clues in making an inference.	Makes inferences with teacher/peer assistance.	Unable to demonstrate inference skills.
Generalized Statements	Able to form a generalized statement based on research, observation, questions, and inference skills.	Able to form a generalized statement with teacher/peer assistance.	Unable to form a generalized statement.

Inferences — Upper Level

Criteria	Proficient	Basic	In Progress
Interpreting	Clearly and accurately selects and describes important information to make general conclusions or statements.	Accurately selects and describes important information to make general conclusions or statements with teacher/peer assistance.	Unable to select and describe important information to make general conclusions or statements.
Explaining	Independently explains interesting ideas or meanings from information.	Explains interesting ideas or meanings from information with teacher/peer assistance.	Unable to explain ideas or meanings from information.
General Conclusions	Independently formulates general conclusions from specific pieces of information or observations.	Formulates general conclusions from specific pieces of information or observations with teacher/peer assistance.	Unable to formulate general conclusions from specific pieces of information or observation.

Elementary Level *Sample Rubrics for Process Skills*

Questioning Upper Level

Criteria	Proficient	Basic	In Progress
Inquiring	Independently formulates logical questions based on facts, concepts, or principles.	Formulates logical questions based on facts, concepts, or principles with teacher/peer assistance.	Unable to formulate questions based on facts, concepts, or principles.
Searching	Formulates questions that consistently interprets and synthesizes information gathered.	Formulates questions that interprets and synthesizes information gathered with teacher/peer assistance.	Unable to formulate questions through interpreting and synthesizing information gathered.
Pertinent Information	Formulates questions paying close attention to detail when appropriate; checks information against all important sources and recognizes inaccuracies.	Formulates questions paying adequate attention to detail when appropriate; checks information against all important sources, and recognizes inaccuracies with teacher/peer assistance.	Unable to formulate questions using details; unable to check information against all important sources and to recognize inaccuracies.

Middle/Secondary Level *Sample Rubrics for Process Skills*

Classifying

Criteria	Proficient	Basic	In Progress
Determine Attributes of Groups	Is able to place in a hierarchy of groups.	Is able to place in groups but in a random manner.	Unable to place all items in groups.
Label Groups	Is able to label groups appropriately.	Is able to label groups appropriately most of the time.	Is not able to label groups appropriately.
Pattern Recognition	Notices patterns among objects and is able to extend pattern.	Notices patterns among objects but is unable to extend.	Unable to determine patterns.

Communicating

Criteria	Proficient	Basic	In Progress
Expressing Ideas	Able to express abstract and concrete ideas clearly and concisely.	Able to express ideas which can be clarified with few questions.	Unable to express meaning of ideas to others.
Organization	Presents ideas in sequential order.	Presents most ideas in a sequential manner.	Ideas are often out of sequence.
Accuracy	Ideas and concepts contain no serious flaws.	Ideas and concepts contain few minor flaws.	Ideas and concepts contain few serious flaws.
Models of Communication	Uses several modes to communicate ideas.	Uses two modes of communication.	One mode of communication used.
Reasoning	Explains thinking processes well.	Able to support simple explanations.	Unable to verbalize thinking.
Questioning	Responds to all questions and initiates questions.	Has difficulty responding to or asking questions.	Does not respond or ask questions.

Middle/Secondary Level Sample Rubrics for Process Skills

Connecting

Criteria	Proficient	Basic	In Progress
Technology	Uses appropriate/available technology effectively and correctly.	Uses some technology in an acceptable way.	Available technology not used.
Integration Across Disciplines	Able to apply ideas to other disciplines.	Able to sometimes apply ideas to other disciplines.	Able to use ideas in a single discipline.
Integration Within Disciplines	Proposes and explores extensions within disciplines.	Able to recognize similar problems or applications within disciplines.	Does not attempt to make connections within disciplines.
Connecting to "Real" Life	Explores "real" life situations connecting many disciplines.	Explores "real" life situations connecting some disciplines.	Attempts but is unable to explore "real" life situations connecting other disciplines.
Relationship	Relates objects, data, and procedures in one situation with real-life situations.	Misses critical relationships between real-life situations.	Identifies similar objects, data, or procedures but unable to connect to real-life situations.

Hypothesizing

Criteria	Proficient	Basic	In Progress
Explains Inferences	Explains all inferences.	Explains some inferences.	Does not explain inferences.
Explains Observations	Writes a statement based on many observable sources of information.	Writes a statement based on some observable sources of information.	Writes a statement not based on observable sources of information.
Generalized Statement	Is able to write a generalized statement as a null hypothesis.	Is able to write a generalized statement.	Is unable to write a generalized statement.

Inferring

Criteria	Proficient	Basic	In Progress
Make Inferences	Able to accurately infer properties or occurrences about observations and/or data.	Able to sometimes make an inference about properties of data and observations.	Unable to accurately infer properties about observations and/or occurrences about data.

Middle/Secondary Level — Sample Rubrics for Process Skills

Interpreting Data

Criteria	Proficient	Basic	In Progress
Draw Conclusions	Able to state a clear and accurate conclusion from data.	Able to state a clear and accurate conclusion most of the time.	Unable to make a clear conclusion.
Read Data	Able to make interpretation of data and is aware of exceptions.	Able to make interpretations but is not aware of exceptions.	Unable to make interpretations and is unaware of exceptions.

Measuring

Criteria	Proficient	Basic	In Progress
Measurement Tools	Can determine appropriate tool to use for measurement.	Can determine the appropriate tool to use most of the time.	Cannot determine the appropriate tool.
Read Measurements	Can accurately read measurement tool by increments to its significant digit.	Can accurately read measurement tool.	Cannot accurately read measurement tool.
Unit of Measure	Can determine appropriate unit of measurement to use.	Can determine the appropriate unit of measurement most of the time.	Cannot determine the appropriate unit of measurement.
Standard vs. Nonstandard	Can measure and/or estimate between standard and nonstandard units.	Uses limited estimation between standard and non-standard units.	Unable to estimate between standard and non-standard units.

Modeling

Criteria	Proficient	Basic	In Progress
Constructing a Model	Able to construct a model illustrating the concept and explain the relationship.	Able to use a model illustrating the concept and explain the relationship.	Unable to use a model or explain the relationship.

Middle/Secondary Level Sample Rubrics for Process Skills

Observing

Criteria	Proficient	Basic	In Progress
Observing	Methodically and thoroughly records observations.	Records observations.	Randomly records observations.
Using Five Senses	Uses all five senses as appropriate.	Uses most of the senses as appropriate.	Uses one sense to gather information.

Patterning

Criteria	Proficient	Basic	In Progress
Locating Patterns	Able to locate a repetitive pattern in many events or problems.	Able to locate repetitive patterns in most events.	Has difficulty locating patterns.
Expressing Patterns	Expresses patterns using variables.	Expresses patterns using examples.	Unable to express patterns.
Extending Patterns	Extends pattern to many other problems.	Extends pattern to some other problems.	Has difficulty using patterns in other problems.
Applications	Able to create parallel problems by varying conditions of original problems. Can apply ideas to new situations.	Able to create parallel problems. Unable to apply ideas to new situations.	Unable to apply to parallel problems.

Middle/Secondary Level Sample Rubrics for Process Skills

Problem Solving

Criteria	Proficient	Basic	In Progress
States Problem	States the problem in her/his own words. Identifies questions that must be answered. Eliminates unnecessary information.	Recognizes the problem. Identifies some questions to be answered.	Cannot recognize the problem.
Hypothesize/ Estimate	Can hypothesize/estimate answer.	Hypothesis/estimate sometimes inconsistent with the problem.	Hypothesis/estimate frequently inconsistent with the problem.
Develop Strategy for Solution	Can develop a clear strategy for solving the problem.	Uses trial and error to develop a strategy.	Cannot develop a problem-solving strategy.
Information	Identifies needed information and shows evidence of research.	Misinterprets or misunderstands related information.	Routinely requires explanation and assistance.
Generalization and Flexibility Estimate	Successfully resolves unexpected difficulties that arise during the process. Is able to generalize findings to other solutions.	Tries to resolve unexpected difficulties that arise during the process. Needs assistance to generalize findings to other solutions.	Refuses assistance. Does not recognize the need for assistance.
Evaluate Answer	Is able to evaluate solution for reasonableness and will redo until reasonable.	Can ascertain reasonableness but cannot redo using a different strategy.	Cannot evaluate or ascertain reasonableness of answer.
Understanding	Uses correctly all process skills as needed. Can restate and explain the problem.	Correctly uses some process skills needed but misses opportunity to use a process skill important to the task.	Uses process skills incorrectly. Misunderstands the problem.

Predicting

Criteria	Proficient	Basic	In Progress
Explaining Predictions	Able to explain how the prediction was made based on prior knowledge, experience, and/or content clues. Refines prediction to suggest a more accurate solution.	Able to explain prediction based on prior knowledge, experience, and/or content clues.	Unable to explain reasons for predictions beyond intuition. Makes unrealistic predictions.

Middle/Secondary Level — Sample Rubrics for Process Skills

Questioning

Criteria	Proficient	Basic	In Progress
Pertinent Information	Generates questions related to topic and identifies pertinent information.	Generates questions related to the topic.	Unable to generate questions related to the topic.
Research on Question/Topic	States the question based on researched information, current knowledge, and observations.	States the question based on observations.	Question is not based on any background observations or knowledge.
Investigative Question	Proposes questions suitable for experimental design or research.	Proposes questions narrowed enough for experimentation.	Proposes questions too broad for experimentation.

Researching

Criteria	Proficient	Basic	In Progress
Access Information	Gathers necessary information using a variety of methods and sources.	Gathers some information using a limited number of methods and sources.	Unable to gather information without assistance.
Interpret Information	Organizes information into a useful form.	Organizes data incompletely.	Cannot organize or interpret data.
Control Variables	Recognizes the value and is successful in controlling variables.	Recognizes the value but does not control variables successfully.	Does not recognize the value of controlling the variables.
Determine Possible Relationships	Correctly identifies relationships, recognizes connections, and synthesizes major ideas.	Able to identify most relationships but has difficulty connecting all ideas.	Does not correctly identify relationships. Can not connect ideas.

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Mathematics Ad Hoc Results

MATHEMATICS AD HOC COMMITTEE

Approved June 16, 1994

006.35 MATHEMATICS

006.35A Grade Levels: 7-12

006.35B Endorsement Type: Field

006.35C Persons with this endorsement may teach mathematics in grades 7 through 12.

006.35D Academic Requirements: This endorsement shall require a minimum of 30 semester hours of mathematics.

006.35D1 The program shall prepare prospective teachers to:

- 006.35D1a Use problem-solving approaches to investigate and understand mathematical content;
- 006.35D1b Formulate and solve problems from both mathematics and everyday situations;
- 006.35D1c Communicate mathematical ideas in writing and orally, using everyday language and mathematical language, including symbols;
- 006.35d1d Make and evaluate mathematical conjectures and arguments and validate their own mathematical thinking;
- 006.35D1e Examine relationships within mathematics;
- 006.35D1f Connect mathematics to other disciplines and real-world situations;
- 006.35D1g Use calculators in computational, graphing, and problem-solving situations; and
- 006.35D1h Use technology to explore and solve mathematical problems.

006.35D2 The program shall prepare prospective teachers to:

- 006.35D2a Apply concepts of number, number theory, and number systems;
- 006.35D2b Apply numerical computation and estimation techniques and extend them to algebraic expressions;
- 006.35D2c Use geometric concepts and relationships to describe and model mathematical ideas and real-world constructs;
- 006.35D2d Use both descriptive and inferential statistics to analyze data, make predictions, and make decisions;
- 006.35D2e Apply concepts of probability;
- 006.35D2f Use algebra to describe patterns, relations, and functions and to model and solve problems;
- 006.35D2g Recognize roles of axiomatic systems in different branches of mathematics such as algebra and geometry;
- 006.35D2h Know concepts of limit, continuity, differentiation, and integration and have a thorough background in the techniques and application of calculus;
- 006.35D2i Have knowledge of concepts and applications of discrete mathematics such as graph theory, matrices, recurrence relations, linear programming, difference equations, and combinatorics;
- 006.35D2j Use mathematical modeling to solve problems from fields such as natural sciences, social sciences, business, and engineering;
- 006.35D2k Have knowledge of concepts in Euclidean and non-Euclidean geometries;
- 006.35D2l Apply major concepts of linear algebra;
- 006.35D2m Have knowledge of major concepts of abstract algebra; and
- 006.35D2n Have knowledge of historical development in mathematics that includes contributions of diverse cultures.

006.35D3 The program for prospective teachers may include the following course work: Pre-calculus, Calculus, Logic/Foundations, Linear Algebra, College Geometry, Probability and Statistics, Discrete/Finite Mathematics, History of Mathematics, Abstract Algebra, and Computer Programming and Applications.